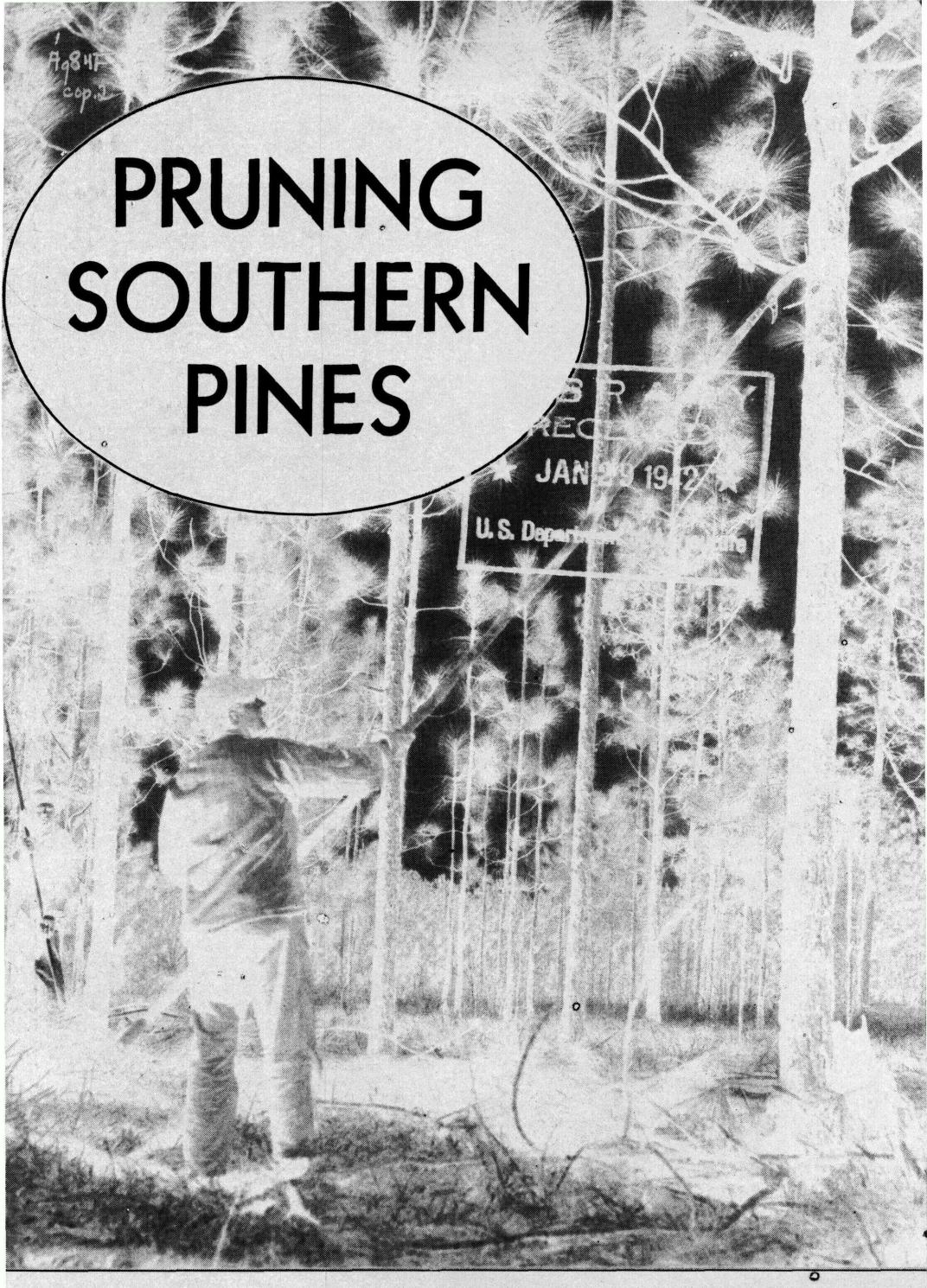
# PRUNING SOUTHERN PINES

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THE GROWING of pines in the South as a crop on the farm, whether for home use or as a source of cash income, or on a larger scale as a commercial enterprise for profit is well on its way as one of the South's most profitable developments.

Better management of growing timber calls for protection from fires, the improvement of stands by thinning or cutting out the unpromising trees, and pruning the promising trees where natural pruning does not take place.

By far the bulk of the pine timber in the South is growing in understocked stands, stands having too few trees per acre. Such uncrowded trees generally grow rapidly in diameter and branch freely, with the result that the trunks taper sharply and have a high percentage of sapwood and many knots.

Proper pruning of young trees practically guarantees high-quality timber, as knots constitute the only common defect in second-growth southern pine timber.

Early pruning, when the trees are relatively small, tends to keep the cost within economic limits, and small clean trees mean large trees of high quality. Such trees, in turn, mean increased profits from the growing of timber as a crop.

**Washington, D.C.** **Issued January 1942**

COVER PHOTO—PRUNING PINE TREES WITH A POLE SAW. F-379136.

# PRUNING SOUTHERN PINES

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## Introduction

KNOTS IN WOOD are crosscut sections of limbs or branches of trees and constitute a well-known defect in the quality of timber. Pruning the side limbs on tree trunks stops the formation of knots in the wood.

Clean tree trunks, stems, or boles make clear wood, and this, in turn, means clear lumber or other timber products. Clear saw-logs are worth from 2 to 3 times as much as knotty logs. Upper grades (B and better) of southern pine lumber usually sell for $20 to $30 more per thousand feet than No. 2 common lumber. There is very little demand for very knotty logs or poles, and even the pulp mills refuse to take too much knotty wood, such as that produced by very open-grown, limby, or bushy-topped trees.

Young pines growing in close stands generally prune themselves fairly well. The lack of sunlight causes the lower limbs to die, and the prevailing moisture in the shade hastens the decay of the wood and the dropping of the branches.

Yet in many so-called well-stocked stands the dominant trees are relatively open-grown at early ages and develop limby trunks. The desirable natural pruning does not take place; and, unless pruned by man, the trees continue to produce only low-grade, knotty timber.

Farmers, particularly, can often afford to prune the promising trees in young stands, especially by using spare time. It pays to grow high-quality cotton, high-quality corn, or high-quality timber for the same reason, namely, because all products of high quality bring larger returns than those of low grade. And, the difference is probably greatest in the case of timber. With pruning, it requires no longer to grow a clear log than a knotty log.

The purpose of this bulletin is to offer information that may be helpful in answering questions as to when or under what conditions the pruning of forest trees is advisable and how it should be done to be most successful and profitable to the woodland owner.

* Mr. Mattoon died in 1941.

## WHY PRUNE TREES?

The practice of pruning pines is relatively new, and doubtless much remains to be learned about it. In various parts of the South, landowners are quite generally doing some pruning. The Forest Service has been doing an increased amount of pruning on the national forests, the States and other agencies have done considerable pruning of trees along highways and elsewhere, and the Soil Conservation Service is including pruning regularly in woodland-improvement practices. Much of this pruning work has been possible because of the availability of the Civilian Conservation Corps.

Aside from the fact that pruning will increase the quality and value of the timber products, whether for sale or for use at home (fig. 1), there are other reasons for pruning pines.

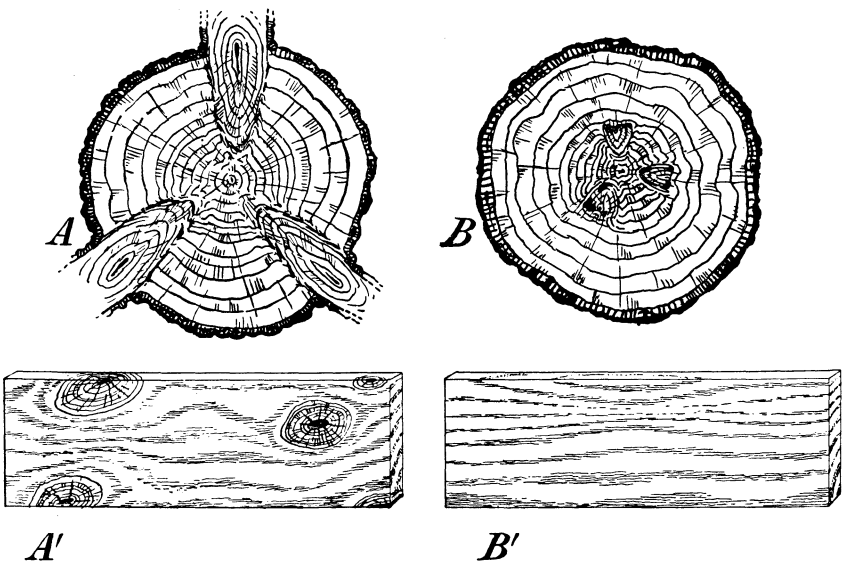


FIGURE 1.—Relation of pruning and knots in lumber. *A*, Cross section of limby tree at a whorl of side branches each one of which is forming a knot increasing in size. *A* [1], Knotty board produced from the above tree. *B*, Cross section of a similar tree pruned in early life. *B* [1], Clear board sawed from the above tree. A specific inquiry in a South Atlantic Coast State (in 1939) showed that average knotty lumber (No. 3 Common) was worth $16, and the upper grades of lumber (B and better) $44 per thousand board feet—a difference of $28.

NATURAL PRUNING OFTEN INADEQUATE.—Natural pruning often fails or is unsatisfactory. This is especially true in stands which as a result of irregular seeding are not sufficiently dense to prune naturally (fig. 2).

Natural pruning of southern pine in well-stocked stands, according to a recent study, requires an average period of from 6 to 12 years after the branches die. Slash and longleaf pines prune themselves in an average of 6 years after the branch dies, loblolly in about 8 years, and shortleaf pine in about 12 years.[1] In this connection, it

[1] Slash pine *Pinus caribaea*, longleaf pine *Pinus palustris*, loblolly pine *Pinus taeda*, and shortleaf pine *Pinus echinata*.

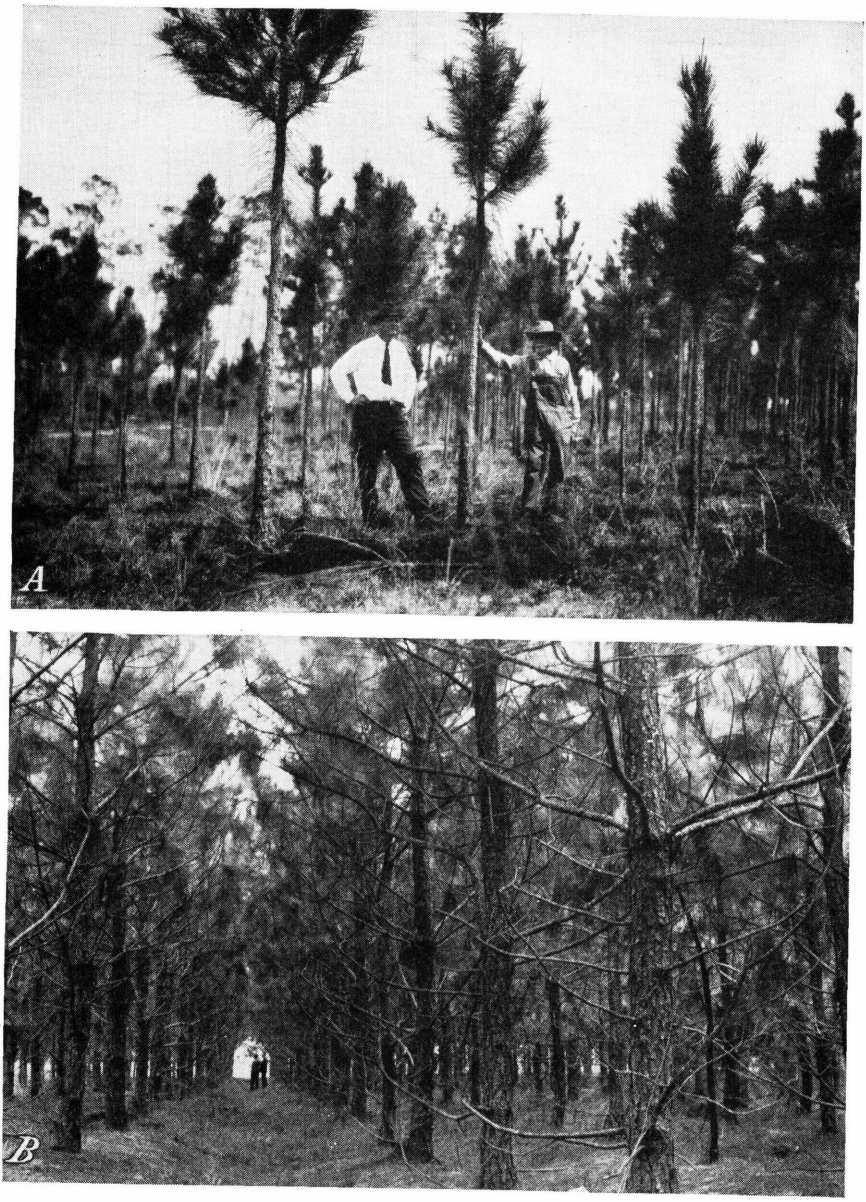


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FIGURE 2.—*A*, As a slack-time winter activity in 1929 and 1930, the farmer (on the right) pruned his young slash pines on 85 acres. When done the pruning was judged by visiting foresters to be too heavy, but experiments since that time indicate that he did a fairly good job by pruning up to about two-thirds of the trees' height. *B*, Very thrifty stand of slash pines (planted 8 by 8 feet apart) where pruning 2 years earlier, at age of 6 years, would undoubtedly have been profitable in starting the development of clear timber.

might well be noted that as between these species longleaf and slash grow under conditions of highest temperature and humidity, loblolly is intermediate in this respect, and shortleaf grows under the driest and coolest conditions. In individual cases a dead branch has held fast or persisted for 49 years on a loblolly pine, 41 years on a shortleaf pine, 20 years on a slash pine, and 17 years on a longleaf pine tree (fig. 3).[2]

In natural pruning or thinning, first the limb or tree dies from lack of light, the wood is then gradually weakened by decay, and finally the mechanical action of sleet, rain, and wind causes the limb

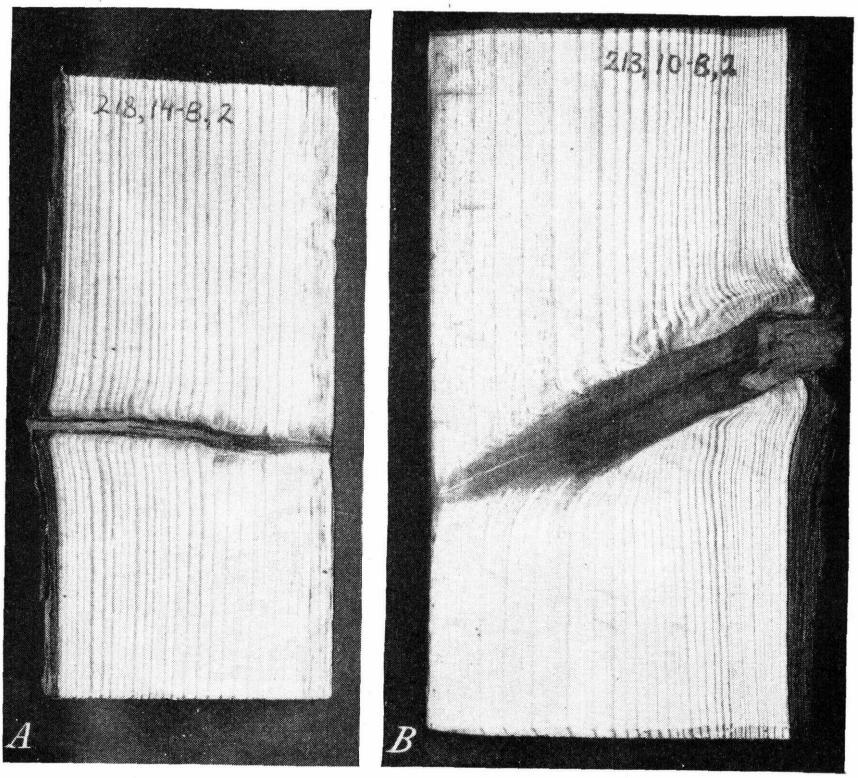


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FIGURE 3.—How dead limbs sometimes persist for many years, forming loose knots in the wood. *A*, A small branch that held on for 25 years after it died; *B*, A large dead stub that continued to form a loose knot for 19 years after dying.

or tree to fall. The slow rate and irregularity of normal pruning of pines would seem to justify fully hand pruning of selected trees in many stands.

Figure 4 shows the inside appearance of a butt log that has been split lengthwise through the middle, revealing in the central position the wood with tight knots resulting from living branches; next, the wood with "black," or loose, knots resulting from dead branches

[2] Forest Products Laboratory, U. S. Forest Service, Madison, Wis. Acknowledgment is also made for the use of figures 4, 12, 19, and 20.

persisting on the tree; and outside the wide layer of clear wood formed since the tree was pruned.[3]

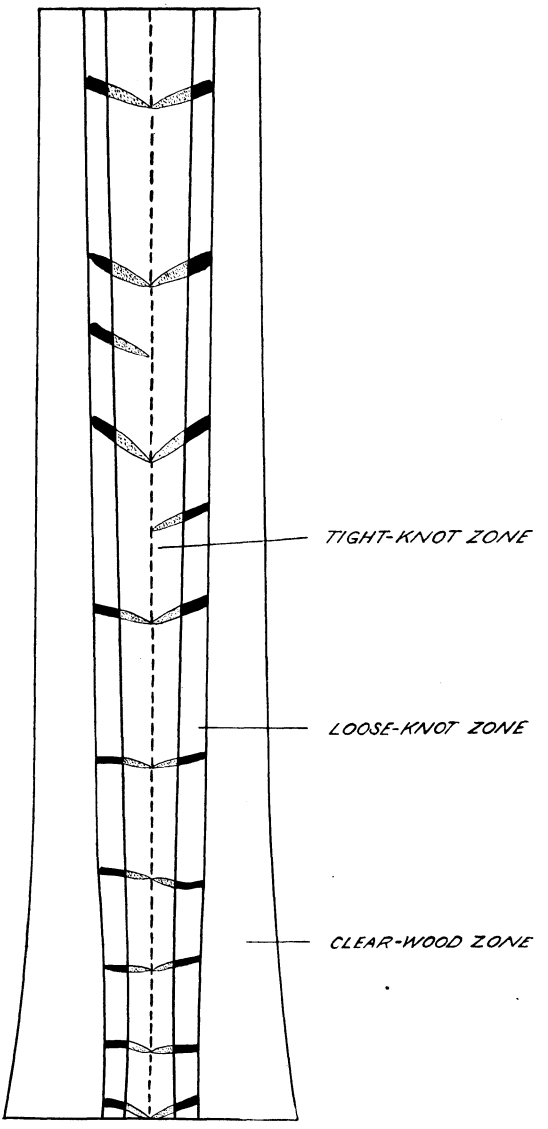


FIGURE 4.—Diagram of a 16-foot lobolly pine butt log cut open lengthwise through the center. Note how the live branches produce tight knots in the wood (central zone), dead branches produce loose, or "black" knots (the zones on both sides of the central zone) and, after the branches were pruned, the tree produced clear wood (the two outside zones).

[3] For detailed information on the persistence of limbs on pines, formation and structure of knots in wood, and qualities of lumber resulting from pruned and unpruned trees, reference should be made to the publication Knots in Second-Growth Pine and the Desirability of Pruning, U. S. Dept. Agriculture, Misc. Pub. 307.

WOODS-FIRE PRUNING.—Woods fires cause a vast amount of destruction and injury to timber, particularly young stands. Woods fires and poor cutting practices are main causes of the necessity for hand pruning trees. Their effect is to reduce the number of trees to a density below that desirable for the best growth and development. If such open-growing timber is ever to have even a fair value, it must be improved by pruning.

Surface fires sometimes result in the pruning of the lower branches of trees up to a height of 8 to 12 feet, and sometimes higher. At best this is hit-and-miss pruning and is also unsatisfactory because fires usually deaden rather than burn off the branches, and it is years before they drop off. Under present better forest-management practices, woods fires are becoming less frequent and destructive, and as a result stands are denser, and natural pruning can take place.

TURPENTINING.—Straight, clean-bodied trees present a more pleasing and thrifty appearance than do very limby, "horny," or rough trees, whether growing about the farm in patches or in the farm woods. But this is a matter of secondary importance. For turpentine working on longleaf or slash pines, however, it is quite necessary to have tree trunks clear of branches up to about 9 feet in height.

FUSIFORM RUST.—The spread of, and local injury to trees by, the fusiform rust (spindle rust, or rust canker) (*Cronartium fusiforme*), a disease mainly infecting slash and loblolly pine,[4] may be checked by the pruning of infected side branches when the trees are very young. (See p. 3.)

## WHEN IS PRUNING PRACTICAL?

Because conditions vary widely, it would be difficult to answer completely the question: When is pruning advisable?

### *Prune—*

1. Selected trees—sound, straight, thrifty, evenly spaced, and promising for high-quality products.
2. Smaller or younger classes of trees.
3. Close to tree trunk, so as to leave no portion of a stub.
4. Not more than two-thirds of the total height of the tree, or more than the lower one-third of the live crown or top.
5. A second time, if necessary, to produce at least one clear 16-foot log and, on the best grade of tall timber, to get long, clear poles or two 16-foot logs.

[4] Rarely serious on longleaf pine and does not infect shortleaf pine.

SIZE OF THE TREES AND THEIR BRANCHES.—It is obvious that it requires less labor to prune small branches than large ones. Likewise, it is well known that branches, like trees, get larger by growth each year and large branches heal over slowly and often incompletely. Therefore, pruning trees when they are young and small is better and cheaper for the landowner. This is true even if a second or third pruning is needed at intervals of 5 years or so. Pruning small trees presents the problem of selecting the most promising trees, and the tendency is to select and prune more trees per acre than can be grown to the desired sizes for high-quality crop products. Pines do not replace branches by sprouting.

Pruning is generally practiced on pines from 3 to 8 inches in diameter breast high (4½ feet above the ground), but smaller and larger trees can sometimes be pruned economically.

Pruning should generally be limited to trees with branches up to 2½ inches in diameter. Such trees are regarded as reasonably safe from infection by disease, and pruning them is considered practical from the standpoint of cost and expected money returns.

Some practical authorities advocate that pruning be started only after the trees in the stand reach such size that the pruning can be done profitably along with improvement thinning, or, in other words, when the less valuable trees which should be cut out can be used for fuel wood, tobacco wood, pulpwood, or some other purpose, and thus pay their way. This means that the trees will have reached sizes of at least 5 to 10 inches in diameter. At that time, it is claimed by some, the average owner is better able to decide which trees should be pruned, and his labor costs will not be tied up for so long a time as when trees are pruned earlier. In other words, the owner will practically be able to foresee with assurance the financial advantage of pruning.

PROSPECT OF MARKET FOR HIGH-QUALITY PRODUCTS.—This is an important matter for consideration. The prospects for future demand for trees that will produce high-quality logs, veneer bolts, or poles are seemingly very favorable. Recent developments include improved local transportation over highways to milling, shipping, or other marketing points. Generally, there is no shortage of wood, as such, but rather a shortage of high-quality timber.

It is the assured enhanced value of clean-bodied, straight, and sound trees and prospective increasing demand that justifies the expense of forest pruning. Information on costs and returns of pruning is given on pages 28 to 32.

SELECTION OF TREES.—It follows obviously that only those trees should be pruned which are to be grown for high-quality timber crops or turpentining. The development of such trees from fully stocked young stands necessarily means careful selection as to form, soundness, vigor of growth, and spacing in the stand. Since only a limited number of the trees in fully stocked young stands can be left to form the main crop of high-quality trees, it will be necessary to make repeated thinnings and prunings. It is most economical to make the thinnings when the trees to be removed have value as fuel wood, pulpwood, or other products.

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## ESSENTIALS OF GOOD PRUNING

Before going further into the subject it seems desirable to mention briefly the more essential features or steps in forest-pruning operations.

1. Of first importance—all branches should be cut in such a manner as to leave no stubs or parts of stubs, but only clean surfaces, or wounds, very close to the tree trunks and also so as to cause no injury to other portions of the tree. Flush cutting favors rapid healing.

2. The cut must be started and made deep in the bark of the tree so that the cambium or outer layer is wounded all around the base of the branch.

3. Pruning should begin with cutting the lower dead branches and proceed up the tree, removing a portion of the living branches from the tree's crown. (See p. 11.)

4. If the pruning is done as indicated (under 1 and 2) the healing-over process is hastened to the highest degree. If a stub—even a short one—is left, several years of additional growth will be required before the wound will heal and clear wood be formed over it.

5. Severed branches should be removed from the base of the tree, if possible to a distance of not less than 5 to 8 feet. This will reduce the danger from fire and, in the case of midsummer droughts, of injury from insects.

## TOOLS FOR PRUNING AND THEIR USE

Different kinds of tools are in common use for pruning; some removing only the lower branches and others both the lower and higher branches.

Low, or "ground," pruning is commonly done up to a height of 7 or 8 feet, the height that the average man can easily reach with a hand tool. High pruning usually carries the operation to the height of 17 feet, in order to obtain a clear 16-foot log. Other heights for pruning, such as 11, 13, or 15 feet, may be chosen, depending upon the suitability of the tree trunk to produce clear logs of 10, 12, or 14 feet in length, respectively. The maximum height for pruning in general practice is 33 or 34 feet so as to grow two 16-foot clear logs.[5] On this point see pages 20 to 22 for further information.

Tools for Low Pruning.—Axes should practically never be used for any kind of pruning. It is always a temptation to pick up an ax and use it, especially to one inexperienced in pruning, and the urge is likely to persist until one observes the "butchery," or injury, to trees which almost inevitably results (fig. 5). In exceptional cases fair work can be done cutting in an upward stroke with a sharp ax in very experienced hands.

A saw is the most commonly used tool for forest pruning. It permits close cutting—an important essential. Different types and makes of pruning saws are on the market. Ordinary orchard prun-

[5] Acknowledgment is made of the helpful information and assistance furnished by members of the Duke University School of Forestry, which during the past 6 to 8 years has conducted intensive and comprehensive experiments in pruning shortleaf and loblolly pines.

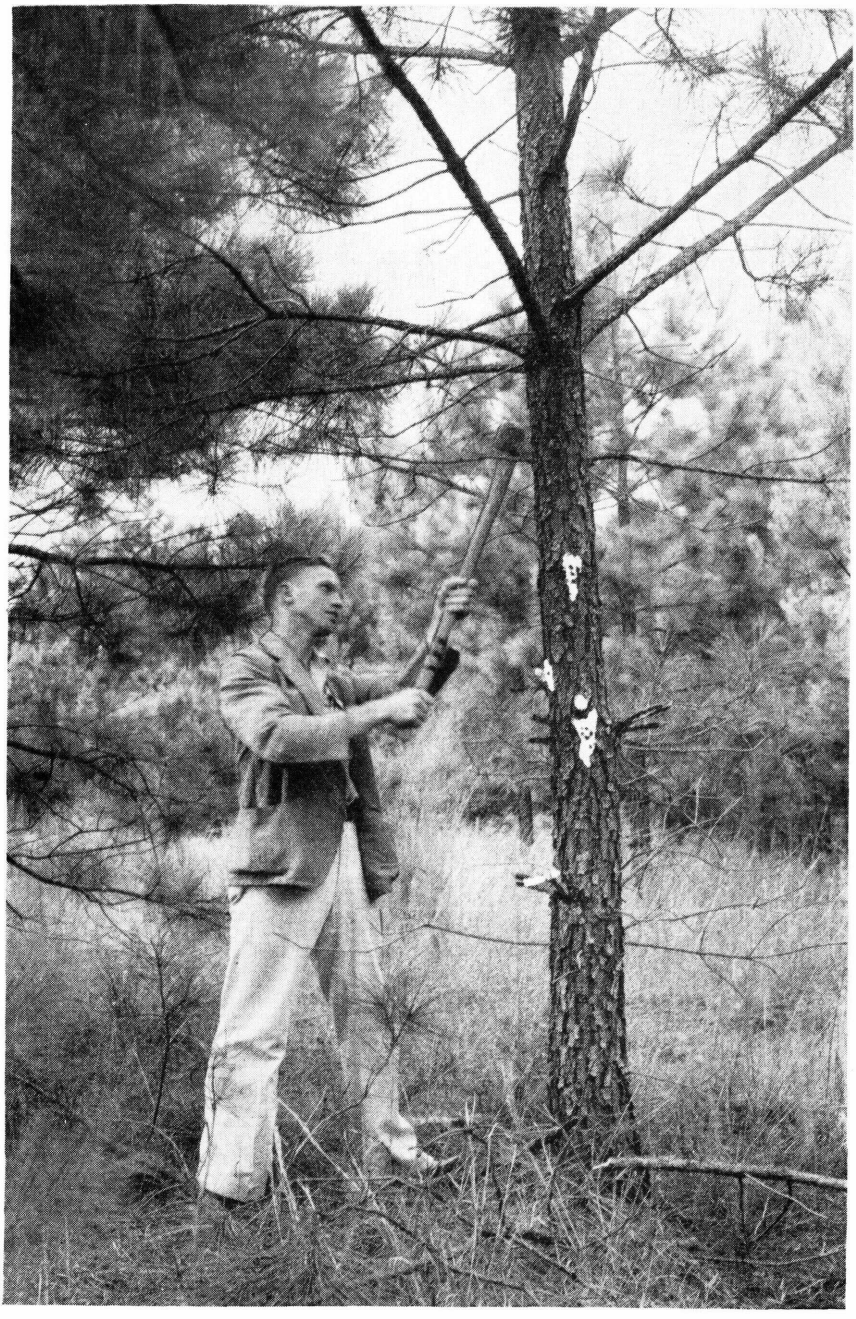

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FIGURE 5.—An ax should not be used for pruning trees. Serious injury usually results from accidental wounds made in the living parts of the tree (inner bark, cambium, and sapwood), and also because of unskilled chopping, long stubs are usually left on the tree.


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FIGURE 6.—Tools commonly used for forest pruning—curved-bladed saws and pruning shears: *a*, Light orchard-type pruning saw with blade 12 inches in length and eight teeth per inch; *b*, heavier "speedsaw" type with 18-inch blade having about five long-pointed, narrow teeth per inch; *c*, gooseneck type of pruning shears, 24 inches in length; and, *d*, pruning shears "point cut," with lever action, 34 inches in length. The latter is made in three models, two of which are smaller and lighter in weight.

ing saws may be bought or ordered from hardware stores, but some of these saws are too light for good forest pruning. Pruning saws mostly have stiff, narrow, curved blades from 12 to 16 inches in length, with teeth that cut on the pull, or down, stroke or on both strokes, and a short pistol-grip handle (fig. 6). For use in forest pruning, where branches generally average larger than in orchards, a somewhat heavier type of saw with long-pointed and coarser teeth (5 to 7 per inch) is preferred by many workers who find that it cuts faster and easier than the lighter type of pruning saw (fig. 7).

The two faster cutting and more satisfactory hand pruning saws used in one official test in ground pruning (up to 8 feet) had very

stiff, narrow blades with very acute and relatively long teeth and the usual pistol-grip handles. One kind had 5½ teeth per inch and cut only on the pull stroke, and another had 8 teeth per inch and cut on both strokes. The latter is sometimes known as the California type of pruning saw.

It should not take long for a person to become used to the motion necessary for cutting efficiently with a pruning saw. If the saw has teeth for cutting only on the down or pull stroke, light pressure should be exerted on that stroke and none on the upward or push stroke. Good sawing with the ordinary hand saw, as is well known, calls for only light to moderate pressure on the saw blade.


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FIGURE 7.—*A*, Heavy hand pruning saw in action. It is suitable for cutting medium to large branches. The blade is rigid and fairly wide, is 18 inches in length, and has about five long-pointed teeth per inch (in groups of cutter and raker), cutting on both strokes. It is one of the heavier types of saw and in strong hands it cuts rapidly and without causing undue fatigue. *B*, Same tree as shown in *A* pruned up to eight feet. Note the desirable closeness of the pruning, seen best in the pruning on the left side of the tree.

Pruning shears, or cutters with two handles, are coming into more general use for low pruning of either dead or live limbs up to a height of 7 or 8 feet. Improved types have two sharp cutting blades (older ones had one dull blade) with lever action and handles 20 to 30 inches in length. The best types permit of easy, rapid and close pruning of limbs up to 2 inches in diameter, with normal working speeds of 5 to 10 seconds per limb, or a possible average speed of about one-half the time required if a pruning saw (figs. 6 and 8) is used.

Tree trimmers with long handles, commonly used in orchards and on shade trees, are not practical tools for forest pruning as the

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FIGURE 8.—Pruning shears are used for low or ground pruning. They are never practical for high pruning. Improved shears like this point pruner have two cutting blades worked by leverage and permit of easy and close pruning. This is a heavy tool—it weighs 7¼ pounds and is 34 inches in length. Some workers prefer the smaller and lighter models which are available because their all-day use is less fatiguing.

branches of forest trees are often more than 1¼ inches in diameter, too large to be successfully cut by these tools.

Clubs are sometimes used for knocking off dead branches. Branches which are about to fall off, and some tight branches can, with a little practice, be broken off fairly close by using a hardwood or other heavy club. A pick handle with an iron spud on the end has been used. At best, using a club is a rough and ready method, in general doubtless better than no pruning, but likely to result in external tree wounds or stubs, except in the case of dead branches that break off easily and deeply in the bark. In the latter case hollows are often left which develop into pitch pockets—a defect in lumber— and provide places where insects or diseases can enter.

Tools, including pruning saws and shears, should be cleaned of pitch or resin occasionally during use and at the end of the day's work or at the end of the job. For this purpose kerosene, or coal oil, is commonly used and is satisfactory.

TOOLS FOR HIGH PRUNING.—High pruning completes the pruning operation, starting from a point 7 or 8 feet above the ground and extending to the desired height, most commonly 17 feet, which provides for a clear 16-foot log.[6] Some trees will be found of such form and condition that they call for pruning to a lesser or a greater height.

Two methods of high pruning are common, namely, using a pole saw—a pruning-saw blade attached to a long pole—or a hand pruning saw from a ladder.

POLE SAWS AND THEIR USE.—Pole saws for high pruning have the same general type of blade as hand pruning saws. In general, the blade should be curved, should not exceed 18 inches in length, and should be relatively narrow, very rigid, and of about 17-gage steel, with from 5 to 7 teeth per inch, and cut on the pull stroke. Light saw blades shimmy when used on poles over 9 feet in length. The best arrangement is for the blade to be attached rigidly to the pole used as a handle. It is possible to buy hand pruning saws with detachable blade which may be bolted to the end of a pole. It would not be difficult to detach a blade from an ordinary hand pruning saw and fasten it to the end of a pole.

Pole saws in common use have handles mostly from 9 to 12, or sometimes 14 feet, in length, but occasionally poles up to 20 feet are used for high pruning (fig. 9). Poles should be stiff and tapering to get a good "balance." Long poles at best are relatively flexible and always top-heavy. In high pruning, pole saws are better suited to use on trees with comparatively few limbs than on those with heavy tops composed of many branches. Obviously it is very unsafe to use a pole saw, even one with a short handle, while working from a ladder.

Pole saws at best are awkward and usually are very tiring at first, but after a little experience many workers prefer them to the handsaw and ladder method of pruning. Workers can be shifted from the high- or pole-pruning to the ground- or low-pruning work to give relief if they become tired working with the pole. No tool or

[6] Actually the minimum height should be 17 feet 3 inches, in order to allow for a 1-foot stump and a log 16 feet 3 inches in length.

method is suited to all workers; therefore, the tools and method used should be suited to the aptitude or liking of the individual worker. A general caution in using a pole saw is to exercise special care and effort to prune close to the trunk and avoid leaving a stub.

*Pruning from a Ladder.*—Ladder pruning calls for the use of a hand pruning saw and a light strong ladder, usually 12 feet in length for pruning to a height of 17 feet. Longer ladders have the disadvantage of insecurity, with attendant danger and inefficiency; yet they are used for the highest ranges of pruning. Indications are that the best type of hand pruning saw for ladder work is one with 6 to 8 teeth per inch that cuts on both strokes.

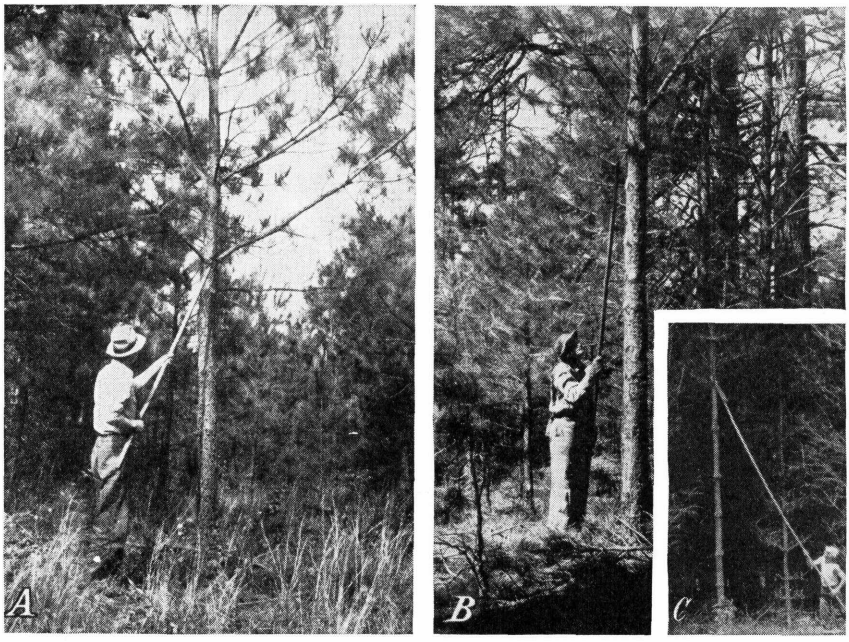


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FIGURE 9.—A pole saw is a standard tool for high pruning—pruning above 7 or 8 feet. An 8-foot pole (*A*) is of convenient length for pruning to heights of from 8 to 12 feet, and a 12-foot pole (*B*) from 13 to 17 feet. The latter is the one in most common use for high pruning. Pruning higher than 17 feet is done with a saw worked from a ladder or, less commonly, with an extra-long pole (*C*).

Ladders should not be used on small trees, those under about 6 inches in diameter (fig. 10). For trees of medium size—5 to 8 inches in diameter—the pole saw usually proves faster and as satisfactory in workmanship. On larger trees, especially those with large limbs, the hand-saw and ladder method has often been the more satisfactory (fig. 11). It is more difficult to find a man who will do good work with a pole saw than with a hand pruning saw and a ladder.

It is quite natural in pruning from a ladder to cut off all the branches as a person works upward on a tree. However, in pruning from a ladder it will be found advantageous to leave all or at least some of the lower branches to help steady the ladder and keep it

from slipping sideways as one works from the upper part of the ladder (fig. 11). A little experience will serve as a guide in the selection of branches to be cut and those to be left until the last before removing the ladder from the tree.

The time and cost factors are higher when a ladder is used than when a pole saw is used because of the work of raising and lowering the ladder, climbing the ladder, moving it about on the tree in order to reach all the limbs and moving it from tree to tree. Records in one test show that about 15 percent of the total time was consumed in raising and climbing a 12-foot ladder, and about 40 percent of the time when a 20-foot ladder was used. One of the merits of ladder


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FIGURE 10.—Using a ladder in pruning small trees is a bad practice. This pine is 5 inches in diameter (breast high, outside the bark) and 22 feet in height. The tree was pruned to the proper height—14 feet, or two-thirds of its total height. *A*, A good start in pruning from the ground, cutting the limbs up to 8 feet in height; *B*, The use of an 8- or 10-foot pole pruning saw instead of the ladder would have been more economical for the high pruning.

pruning is the ease and sureness with which the limbs may be cut very closely, which is conducive to rapid healing.

"TARZAN" METHOD OF PRUNING.—The "Tarzan" method of pruning is one to be considered. It consists of climbing the tree to the height desired for pruning and then working downward, cutting the limbs as one goes. It is practical under certain conditions, especially so where the limbs are green, sturdy, strong, and fairly evenly spaced, and for pruning at a height beyond the reach of an ordinary pruning ladder. With its potential elements for speed and economy the Tarzan method is worth keeping in mind for adequate trial and


F-383022, F-383025 F-383026, F-383027

FIGURE 11.—Pruning a limby but straight and thrifty-growing pine. The small sizes of the limbs make it profitable to prune this tree. Ladders are practical only on the larger sized trees, where pole saws are also often used instead. *A*, A loblolly pine 11½ inches in diameter (breast height) and 42 feet in total height. *B*, The same tree low-pruned from the ground to a height of 8 feet, showing also the beginning of high pruning. *C*, Some limbs were left in working upward to help steady the ladder. *D*, The tree pruned to 17 feet, or about one-half of its total height, to produce a clear 16-foot sawlog. (Photographs taken in Duke University Forest.)

consideration. In pruning southern pines, however, the Tarzan method seemingly has relatively less use than in similar operations on white pines.

How to Obtain Pruning Tools.—The question will arise as to how to obtain the kind of tools desirable for forest tree pruning. It is suggested that those interested seek information from local hardware dealers, mail-order firms, and local county agricultural agents, or from the State forester or the State extension forester located at the State college of agriculture. Most local dealers have catalogs which would at least list ordinary types of hand pruning and pole saws. Pole saws can be made without much cost, but they are likely to be unsatisfactory, as mentioned on page 13.

A caution may well be repeated here that the orchard pruning saws usually found on sale or listed in hardware catalogs are often too light and not as efficient or practical for forest pruning as the special heavier types of pruning saws. The former generally costs from 75 cents to $1, while the cost of the latter type is about $2 to $2.50 apiece.

Light ladders for pruning may be purchased and are well suited to the purpose. Unless carefully made, any sort of a home-made ladder is likely to be too heavy to be practical. Ladders require frequent moving and lifting. Doubtless home-made ladders, if carefully constructed, will be found fairly workable for use in pruning at medium heights or on a small number of trees.

## TIME OF YEAR FOR PRUNING

Doubtless the best time for forest pruning in the southern pines is during the fall and winter. Other work is less pressing, and the wound will get the benefit of the following full growing season. During that period there is less likelihood of fire. For protection from this source of danger it is well to pull the cut limbs away from all trees. Incidentally, the limbs taken in pruning could be used to very good advantage as brush for checking erosion in gullies or as mulch on eroding land surfaces.

Formerly it was thought that pruning should not be done during the summer months because of the danger of insect or "bug" infestation. Recent experience and careful observation, however, have shown rather reliably that pruning can be carried on in the summer without serious menace or risk of insect damage. The only exception would be definitely to avoid such operations during periods of drought, especially extreme droughts such as occasionally occur. At such times the trees become more susceptible to insect infestations. For further information on the subject of insect menace and infestations reference should be made to the mimeographed publication, The Ips Engraver Beetles (E–370), and to Farmers' Bulletin No. 1586, The Southern Pine Beetle, a Serious Enemy of Pines in the South, both prepared by the Division of Forest Insects, Bureau of Entomology and Plant Quarantine.

The Ips beetle is the insect most often associated with slash or tops cut in pruning and logging and the one most likely to cause injury. In periods of summer drought the southern pine beetle may become a real menace.

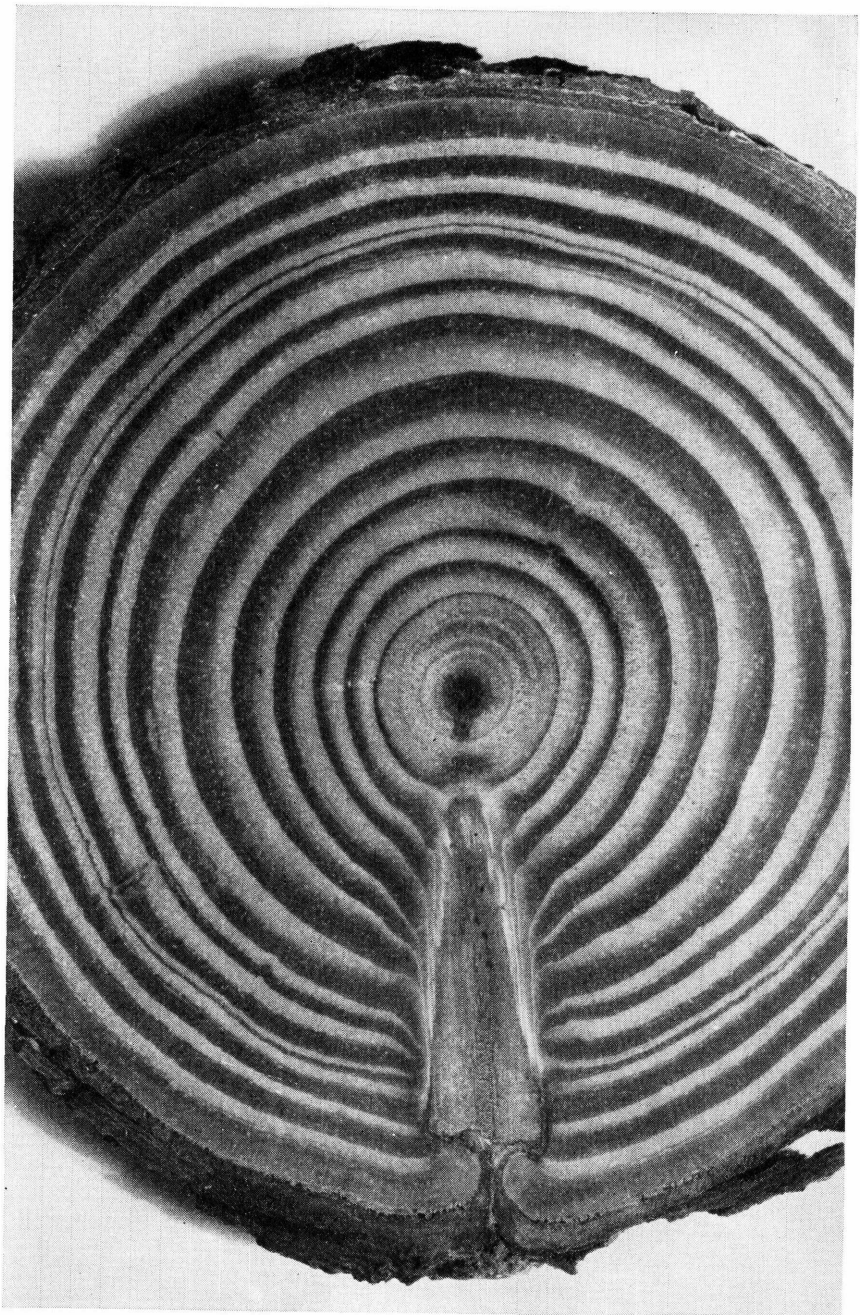

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FIGURE 12.—A knot from a well-pruned limb healing over rapidly in a thrifty southern pine.

## CLOSE PRUNING

In order to cut off the branch close to the last layer, or ring, of sapwood and leave no stub, it is necessary to guide the saw blade into the outer and rough bark at a diagonal angle, or both downward and inward. The cut should actually wound the inner, soft and light-colored bark and the cambium, or very thin growing layer, lying between the inner bark and the outermost layer of wood (sapwood) (fig. 7). With the use of proper pruning saws and more recently improved types of pruning shears, it is quite possible to obtain the desired degree of closeness in pruning tree limbs.

Close pruning favors rapid healing over of the wound. In pruning southern pines the fresh surfaces left by smooth cuts, as a rule, quickly become coated with pitch, or resin, which acts as a protection against disease, infection, or rot. In normally vigorous trees, small to fair-

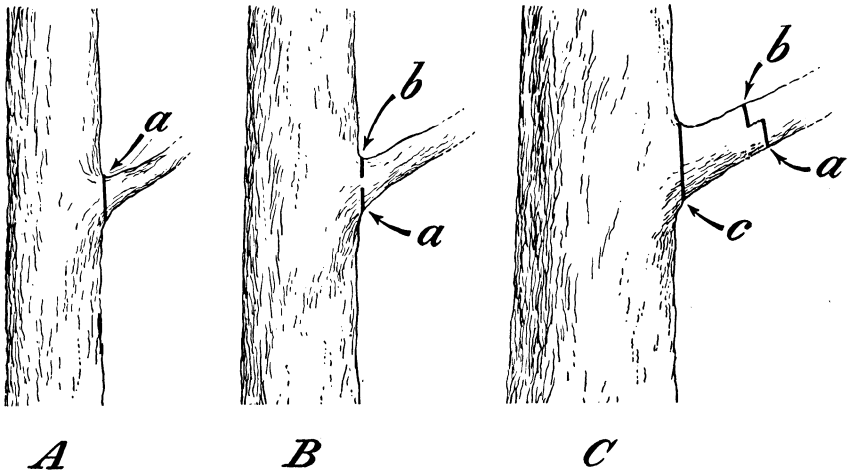


FIGURE 13.—How to cut off different-sized branches in forest pruning so as to avoid possible stripping of the bark and injury to the tree. *A*, Small branches can be cut off by one sawing (*a*). *B*, Branches up to 2½ inches in diameter usually can be cut in the same manner as *A*, but a safer method is to make an under cut (*a*), followed by an over cut (*b*). *C*, If there is special reason to prune branches over 2½ inches in diameter they may best be removed by two complete cuttings—the first consisting of an under cut (*a*), followed by an over cut (*b*), which causes the wood to crack or split and the branch to drop, leaving a stub. A complete, smooth cut is then made (*c*) by sawing off the stub, without injury to the tree.

sized wounds made by very close prunings often become completely covered over during the first or second season of growth. This means that the tree begins laying on clear wood over the end of the knot where the limb was severed (figs. 7 and 12). Less vigorous trees from which limbs are pruned require a longer period of healing.

Care should always be taken in pruning to avoid possible injury to the tree by stripping the bark downward while cutting and dropping the branches. In this respect the southern pines are considerably less subject to injury than is the thin-barked eastern white pine.

Small-sized branches—green or dead—can be pruned and dropped safely by one regular downward cut of the saw. Branches from

1½ to 2½ inches in diameter require a little more care but generally can be cut in the same manner without injury to the tree. In pruning the larger size limbs a good method is to make an under cut, followed by the usual over cut; or a double cut, as illustrated in figure 13.

## HEIGHT OF PRUNING

Pines can be pruned safely, as a general rule, (1) up the trunk to about two-thirds of the total height of the tree; or (2) so as to remove about the lower one-third of the live crown, or top, of the tree (figs. 9, 11, and 14). This will not apply to larger trees (fig. 11) or to slow-growing, stunted, or very bushy topped young trees, on which less of the tree trunk should be pruned. Earlier practice in pruning was to remove only a few of the lower sets or whorls of living branches at a time, depending upon returning and repeating the process several times to carry the pruning upward to the desired height on the tree.

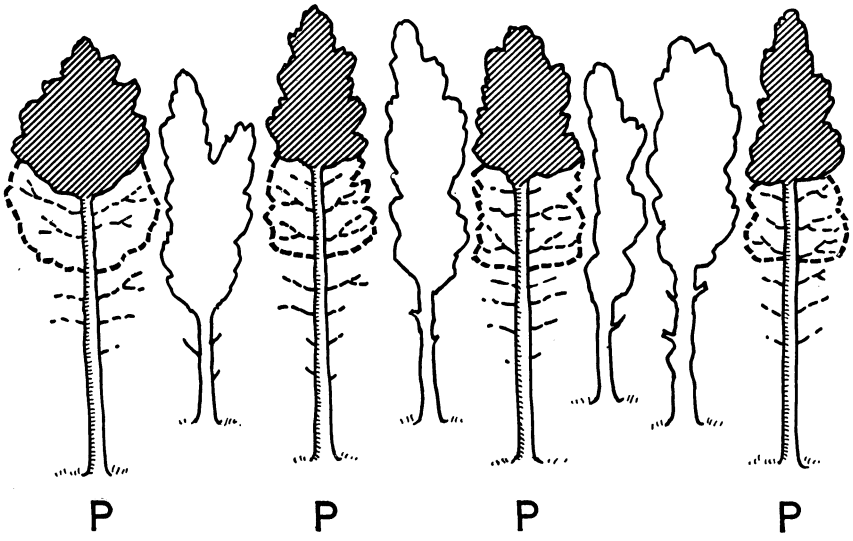


FIGURE 14.—Southern pines can generally be pruned safely to a height of about two-thirds the total length of the tree or so as to remove about the lower one-third of the live-crown, or top. Trees marked "P" have been pruned.

It is always necessary to be cautious about removing at one time too much of the living top or foliage of the tree. In the leaves the raw products of carbon dioxide from the air and water with mineral salts in solution from the soil are manufactured with the aid of sunlight into organic plant foods which, in turn, pass down the tree to form the successive layers, or annual rings, of new wood. Excessive pruning, as will be readily seen, results in an abrupt checking of the normal rate of wood production and, therefore, the desired rate of growth, or increase in the size of the tree. In fact, if all the living branches with their foliage were removed from a pine tree, it would soon die.

A common practice at present is to prune to a height of about 17 feet in order to obtain one 16-foot log. If the form of a tree is such that it cannot be expected to produce at least one such log, it may

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FIGURE 15.—Good forest management is here shown in the growing of trees for high-quality crop products such as large poles, piling, sawlogs, and veneer logs. Six years ago 200 trees, out of a total of 424 trees per acre, were selected and pruned to a height of 26 feet, or two-thirds of their height, as shown. Soon a second and final pruning will be made, up to 34 feet, and at the same time unpruned trees will be cut for various products. (Duke University Forest.)

be questionable practice to prune it. Exceptions are trees with promising shorter trunks, which may be pruned to a height of 10, 12, or 14 feet for clear log cuts, and also slash or longleaf pine trees, which should be cleared to a height of 9 feet for turpentining. These two species of pines when growing in well-stocked stands, are likely to clean their trunks or stems fairly well by natural pruning. Open-grown trees that are rather limby or rough ordinarily will not justify pruning.

Taller, straight, and promising trees are sometimes pruned to a height of 25 feet to get 24 feet of clear logs, or to 34 feet in order to produce two 16-foot clear logs (fig. 15). However, the natural condition of the trunks and tree tops should serve as a guide to the most practical height for pruning, and deciding the number and lengths of the logs that can be obtained should be left to the loggers at the time of cutting. A practical guide, in all cases, is the number, size, and location of the existing limbs. Healing will usually be fast in young and vigorous trees, especially those with small branches, but relatively slow in trees with low vigor and in older trees. The cost of pruning and expected profitability, discussed on pages 28 to 32, of course, enters largely into the question of whether to prune and how far up the tree to prune.

## NUMBER OF PRUNING OPERATIONS DESIRABLE

Often only one operation is necessary to complete the pruning of a tree to any desired height, up to 17 feet. For higher pruning, usually one, or, occasionally, two additional pruning operations will be necessary. Pruning should be done in young stands only where the trees can be pruned to a minimum height of 5 to 8 feet, contemplating, of course, a second operation. In all pruning a prime essential is to avoid cutting off too much of the live crown, or top, of the tree.

The first pruning is often done when the trees are 3 to 6 inches in diameter (breast height). Such trees may be from 8 to 20 years old, depending upon the species and vigor of growth, but size of the tree rather than age is the more essential factor in pruning.

A 5-year interval between prunings seems to be a fairly good average period. If the trees are making a satisfactory rate of growth, they should increase in 5 years a total of from 9 to 15 feet in height and from 1 to 3 inches in diameter, depending upon the kind or species. Here again in pruning, diameter growth is not as important a factor as is increase in height of the tree.

If the pruning is to be carried to heights of 25 to 34 feet, to attain the best and most economical results at least two prunings will normally be required. On the other hand, if the trees at the time of the pruning average, for example, 40 to 50 feet in height, only one such operation may be required.

## SELECTING TREES TO BE PRUNED

The selection of the trees to be pruned is of the highest importance, requiring good judgment and careful consideration. Forest-tree pruning, unlike pruning trees in fruit orchards, is applied only to selected trees and for an entirely different purpose.

Pruning trees and thinning the stand generally go hand-in-hand as improvement practices. Thinning is a practice that aims to remove the less promising trees and stimulate the growth of the best trees in the stand. Several successive thinnings at intervals may be necessary in order to reduce the number of trees to the normal or best number that can grow to high-quality size and product. Each thinning should produce a crop of some sort, such as fuel wood, posts, or pulpwood. The aim always should be to maintain a good tree density, or stocking consisting, as far as possible, of trees of high quality—as the main or chief money crop. Such trees of promise, or quality crop trees in the making, are the ones to select for pruning. The selection, moreover, to be most advantageous and economical, should be made at the time of the first pruning, or when the stand is comparatively young.

Young southern pine stands (loblolly and slash) infected with fusiform rust, or rust canker, can be benefited by pruning limbs

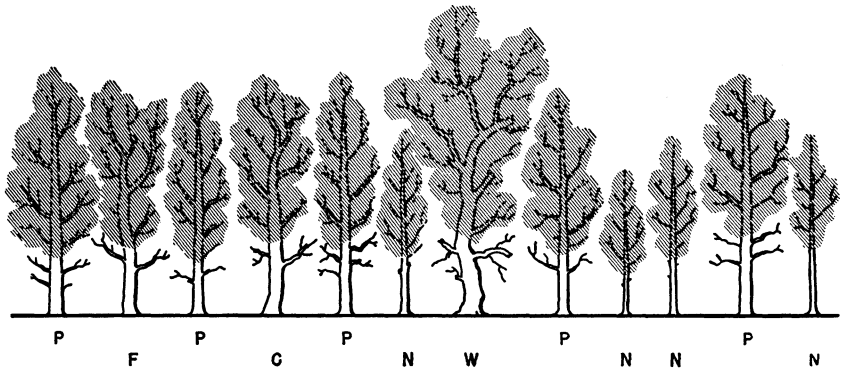


FIGURE 16.—Selecting trees to be pruned. The trees are all normally thrifty pines from 4 to 9 inches in diameter and 25 to 40 feet in height. The five straight, thrifty, promising trees (P) should be pruned for growing high-quality products; the four small trees (N) are naturally pruning themselves; and the other three trees (F, for forked, C, for crooked, and W, for wolf or very limby) should be cut as soon as practicable and utilized for ordinary crop products, such as rough lumber, pulpwood, or fuel wood.

bearing cankers near the trunks. The critical time for doing this is when the trees are from 3 to 5 years old, or about 5 to 10 feet in height. It would also be helpful to larger and older trees to prune such limbs with infection near the tree trunks.

TREES IN CLOSE STANDS.—It would be a waste of time and expense to prune all the trees in an average stand, including those which will be cut because they contain only ordinary or low-grade products. Selecting the trees to be pruned, therefore, requires thoughtful consideration and keeping "an eye to the future." The one who selects the trees to be pruned must size up both the merits and defects of the trees, their vigor of growth and promise, their distribution or distance from other trees of the same class—in other words he must visualize the stand as it is expected to appear 5, 10, 15 or more years later, depending upon its present age, rate of growth, and the kinds of products to be grown (fig. 16).

It is very well to have some reserve supply of pruned trees in the youngest stand or enough to provide for replacing trees that die or are cut for use or sale as they become commercially mature.

Trees profitable to prune include those that will produce poles, piling (although here large knots are not so much of a defect as in poles), veneer logs, and clear sawlogs. Longleaf and slash pine trees that are to be worked for gum or crude turpentine should also be pruned. It is rarely practicable to prune trees that promise the

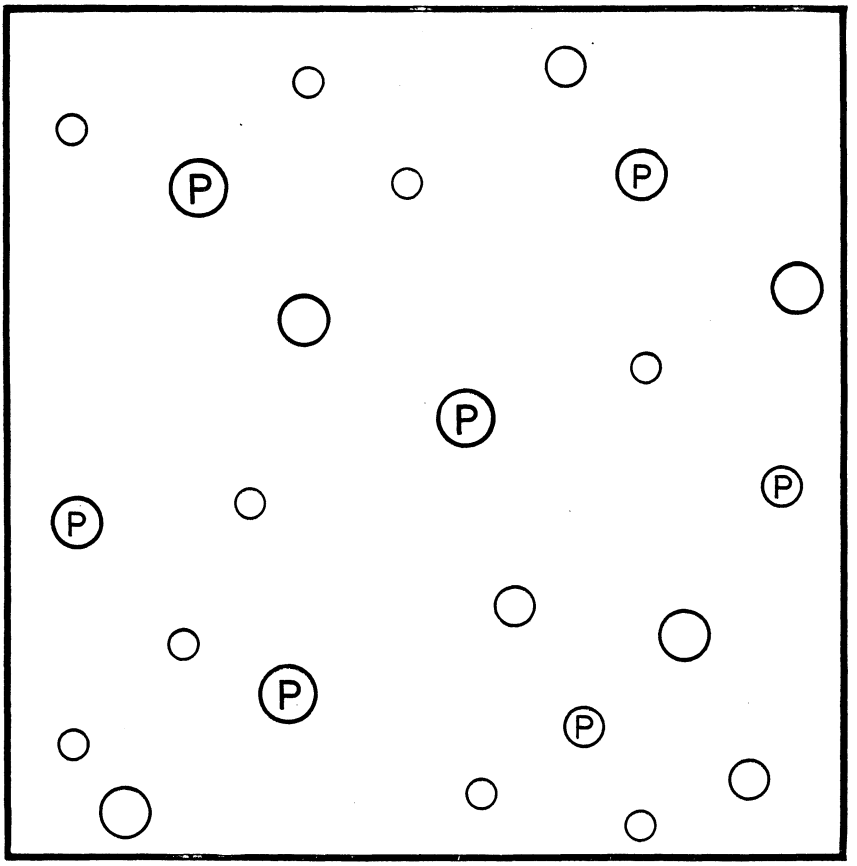


FIGURE 17.—A stand of 23 young pine trees, measuring from 3 to 6 inches in diameter (at breast height). Of these, the 7 marked "P," have been selected for prunings, or about 1 out of every 3 trees. The area is one-fortieth of an acre (33 by 33 feet), so that out of a total of 920 trees per acre, 280 trees are to be pruned for future poles and sawlogs, or high-quality products.

production only of cross ties, pulpwood, fuel wood, or other rough-timber products.

Young stands of pines ranging in diameter from 3 to 5 inches (at breast height) often contain from 300 to 1,200 trees per acre of all sizes. This means that the average distance between the trees is from 6 to 12 feet. Obviously the range of tree densities, or trees per acre, of southern pines is extremely variable, actually all the

way from a few trees to as many as 5 or 10 thousand per acre. To give examples, it might be fairly typical to find stands of pine trees from 3 to 5 inches in diameter where careful pruning operations would result in the selection of from 150 to 300 trees per acre for pruning out of a total of 300 to 1,000 trees per acre, or 1 out of every 2 or 3 trees. Figure 17 shows the selection of 7 out of every 23 trees

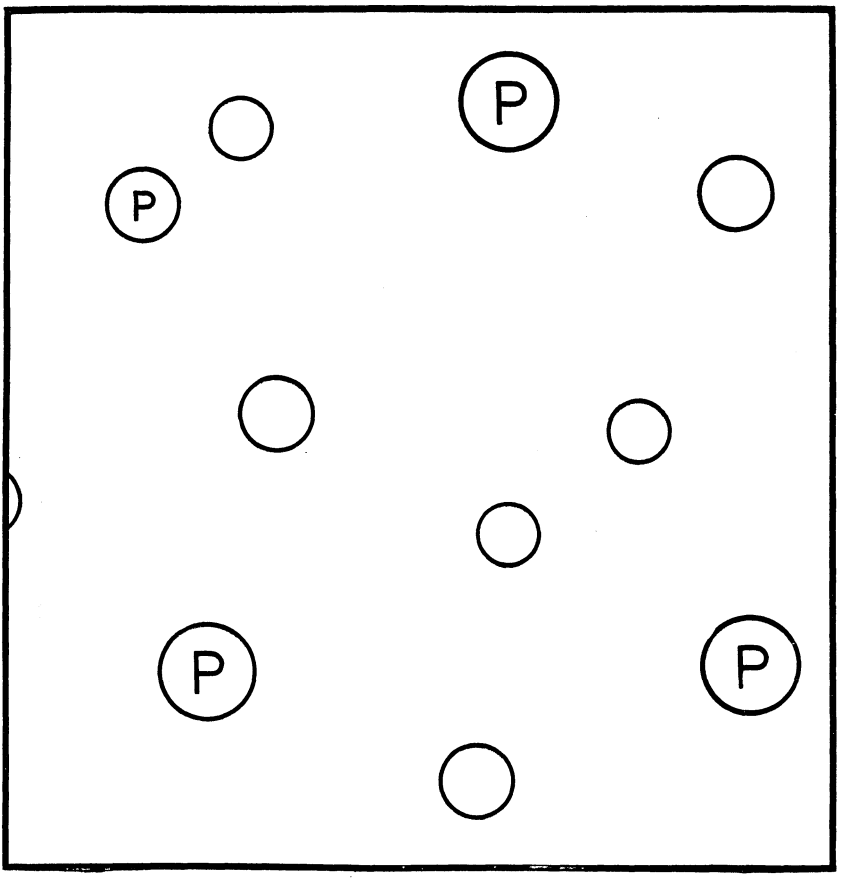


FIGURE 18.—A stand of older and larger trees ranging from 6 to 10 inches in diameter (breast high). Of the 10 trees on this area (33 by 33 feet, or one-fortieth of an acre), 4 show extra promise for growing into high-quality sawlogs or veneer bolts and are therefore selected for pruning and marked "P." This makes a total of 160 trees per acre for the high-quality crop and 240 trees per acre for other cropping for products in which freedom from knots is not so essential.

ranging from 3 to 6 inches in diameter, or a total of 280 trees per acre to be pruned out of 920 trees per acre.

Figure 18 is a diagram of part of a stand in which on each acre there were 400 pine trees ranging from 6 to 10 inches in diameter. Of these, 4 out of every 10 trees were pruned, or a total of 160 trees per acre.

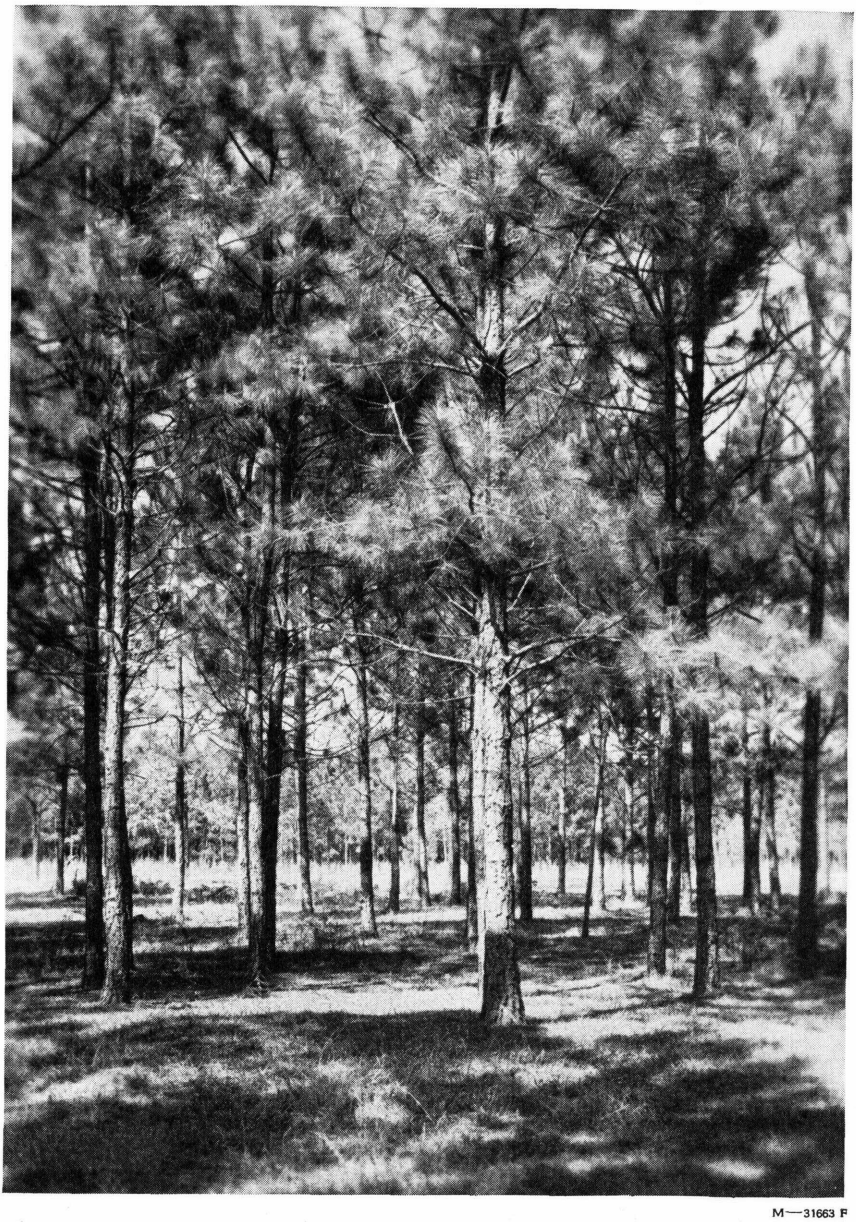

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FIGURE 19.—A stand of open-grown pines which should be pruned soon if they are to grow clear, high-quality timber products.

In the denser stands some of the trees will probably be cut from time to time for poles or other products. The early pruning will develop high-grade products.

OPEN-GROWN TREES.—Trees that have grown partially in the open in understocked stands where sunlight has been available, generally

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FIGURE 20.—Pine trees in an understocked stand that are mostly beyond the sizes for profitable pruning. Such limby or rough trees will produce only low-grade lumber, pulpwood, or other cordwood products.

have numerous branches and are full-topped. This is the class of trees, particularly the younger and smaller sizes, in which pruning is most practical and proves most profitable. Not infrequently such trees, if taken in time, even though up to 10 inches in diameter, may advantageously be pruned so as to produce at least one clear 16-foot

log (figs. 11 and 19). The question of pruning the most promising trees higher than 17 feet so as to yield 18, 20, 22, 24, or 32-foot clear lengths should be considered (fig. 15).

To accomplish this result it may and often will be necessary to prune, at least a second time since no single pruning would, as a rule, be carried as high up the tree as the usual two-thirds of the total height of the tree or as the lower third of the live crown recommended for younger trees in close stands.

Caution and special care should be exercised against the selection of such open-grown trees as are beyond the age and size for profitable pruning (fig. 20). However, if the trees have only relatively few limbs over 2½ inches in diameter, a little effort spent in pruning them will often give good financial returns because such trees are making a good rate of growth and rings of clear wood will form as soon as the wounds heal over. Undoubtedly it would have proved more profitable had the trees been pruned when the branches were smaller, even though they had needed two separate prunings.

Occasionally a tree is found with one or two large limbs on one side and small limbs on the other three sides. It may prove decidedly profitable to prune all of the small limbs, together with any dead stubs, as that can be done at a low cost. The resulting log will thus have three clear faces.

MARKING TREES SELECTED FOR PRUNING.—Trees selected for pruning should be designated in some simple, clear manner. The actual selection of trees, as elsewhere pointed out, is a matter requiring most careful consideration and good judgment. The designation of the trees in advance of pruning will enable the pruners later to proceed without loss of time and greatly lessen the risk of making serious mistakes. For designating trees a cheap grade of white paint, whitewash, or crayon has proved satisfactory. Another method is to designate each tree to be pruned by a small piece of stiff paper fastened by a large tack. A good practice is to mark the trees at about breast height and always on the same side, for example, on the south or the east side. It would be well to have a boy or man helper to do the marking, since the person judging the trees should stand at a fair distance away from them. It is advisable to complete the job of designating the trees on a given tract or part of it before beginning the operation of pruning.

A relatively high-class worker is obviously required to do a good job of selecting the trees to be pruned for growing timber of superior quality. The pruning can be satisfactorily done, after some training and experience, by less skillful labor.

## COST OF PRUNING AND RETURNS

Pruning can be done profitably if the right kind of trees are selected and the work is done properly.

The question whether the pruning of a specific or selected tract of southern pines will pay can hardly be answered concretely in terms of dollars and cents. The reason is that tracts of timber vary widely in age, form of trees, and thrift of growth. In parts of the South pruning is coming into general favor and practice because of the good promise it offers of profitable returns. When properly done, pruning is beneficial to all the important species, or kinds, of southern pines,

including shortleaf, loblolly, slash, and longleaf. Of these, loblolly pine tends to develop and hold relatively large branches and, therefore, is benefited much by proper pruning. Shortleaf pine develops small but persistent branches. Slash pine tends to prune itself fairly early, as does long-leaf, and these two rank highest in the early dying of side branches and, therefore, in the formation of knot-free wood. Pruning of both slash and longleaf pines, however, is being increasingly practiced for the double purpose of producing better timber and knot-free faces for chipping for turpentine. The longer a tree

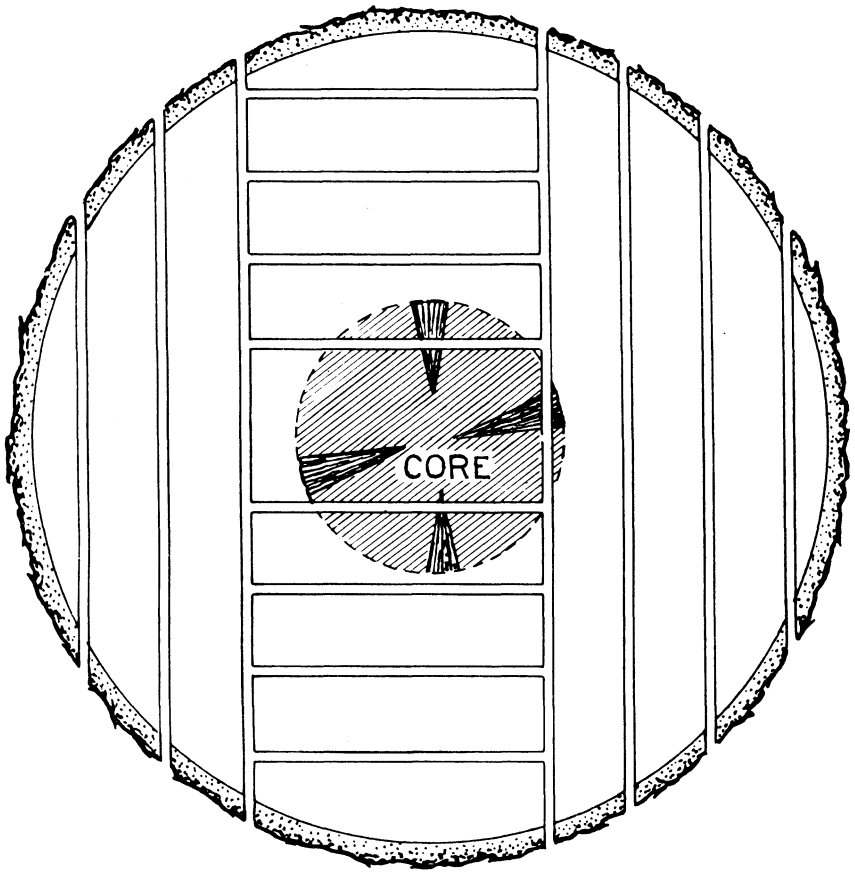


FIGURE 21.—This butt log, 12 inches in diameter (top end), came from a tree that was pruned when about 6 inches in diameter (breast high, outside bark). The knotty wood center, or core, is about 4 inches in diameter. The log has been sawed into 1-inch boards, mostly clear lumber.

stands after pruning the greater the benefit derived. At least 4 inches of clear wood should be added or grown (an increase of 8 inches in diameter) in order to materially raise the grade of the resulting lumber (fig. 21).

TIME AND COST EXAMPLES.—The cost of pruning trees as an improvement operation in growing tree crops varies widely depending upon how, when, and where the work is done; that is, what trees are

selected, their condition as to number and size of limbs, when or at what size or age they are pruned, the degree of efficiency and skill of the labor, and the wage paid (fig. 22).

At the outset it should be stated that forest pruning as described is regarded as primarily adapted for application on farms. Because of their variable schedules of work during the different seasons, farmers and their tenants are in a good position to do some pruning as an investment when other farm work is light. The wage or labor costs referred to in the following discussion are based chiefly upon labor costs or values at home on the farm.

In one large operation in the South the pruning was done by a crew of four men. One man working with pruning shears and pruning up to a height of 8 feet was able to keep well in advance of two men following and working with pole saws. A fourth man pulled the brush away from the trees and either scattered it or piled it in small piles in openings for burning. The slack time of the first man was used in helping the last man handle the brush. The second man used a 10-foot pole saw and was followed by the third man using a 16-foot pole saw. This proved to be a good arrangement, especially as the stand of trees was fairly heavy, or well-stocked.[7]

In another case, a man using a hand-pruning saw and later a pole saw made an average record of one hundred 5-inch (diameter) longleaf pine trees (per acre) in 6 hours, or about 16 trees per hour. This is at a rate of slightly less than 4 minutes per tree for pruning up to a height of 17 feet, which checks fairly well with the recorded time of other work on trees of a similar character.

An examination of the lumber cut from a stand of 4½ acres of 42-year-old pines grown in Louisiana showed a yield of 2½ percent of grade B and Better, which is the best grade. If the crop trees had been pruned when they were not more than 15 years old to a height of 17 feet, these clear 16-foot butt logs would have produced 42 percent of B and Better lumber.

*Pruning Eastern White Pine in the South.*—Eastern white pine (*Pinus strobus*) is native and is also largely planted in portions of the southern Appalachians. The white pine holds its dead branches tightly for many years, which makes pruning relatively very laborious, but, under proper conditions, it is generally considered practicable and profitable. Landowners or others interested either in pruning white pine or in making a comparison with similar work on southern yellow pines, will find the following discussion of value.

The concrete example which follows points out the essentials of a pruning and thinning operation in a white pine stand of trees that were originally planted in rows 6 feet apart each way. At the time of pruning in 1935 the trees had dead, persistent limbs up to 8 feet that formed a dense impenetrable thicket. The trees, then 20 years old, were about 35 feet in height and averaged 5 inches in breast-high diameter.[8] One man pruned with shears up to 8 feet, and another followed with a combined pole saw and clipper, pruning up to 17 feet. A total of 3,720 trees, or 415 per acre, were pruned. This represents

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[7] GEDDES, J. G., and ERICKSON, A. G. THE USE OF THE TWO-HAND PRUNING SHEAR IN FOREST PRUNING. Jour. Forestry, 37: 519–521. 1939.

[8] White pine planted in 1917 near Cliffside Lake on the Nantahala National Forest, in southwestern North Carolina. The trees were 3 years old when planted.

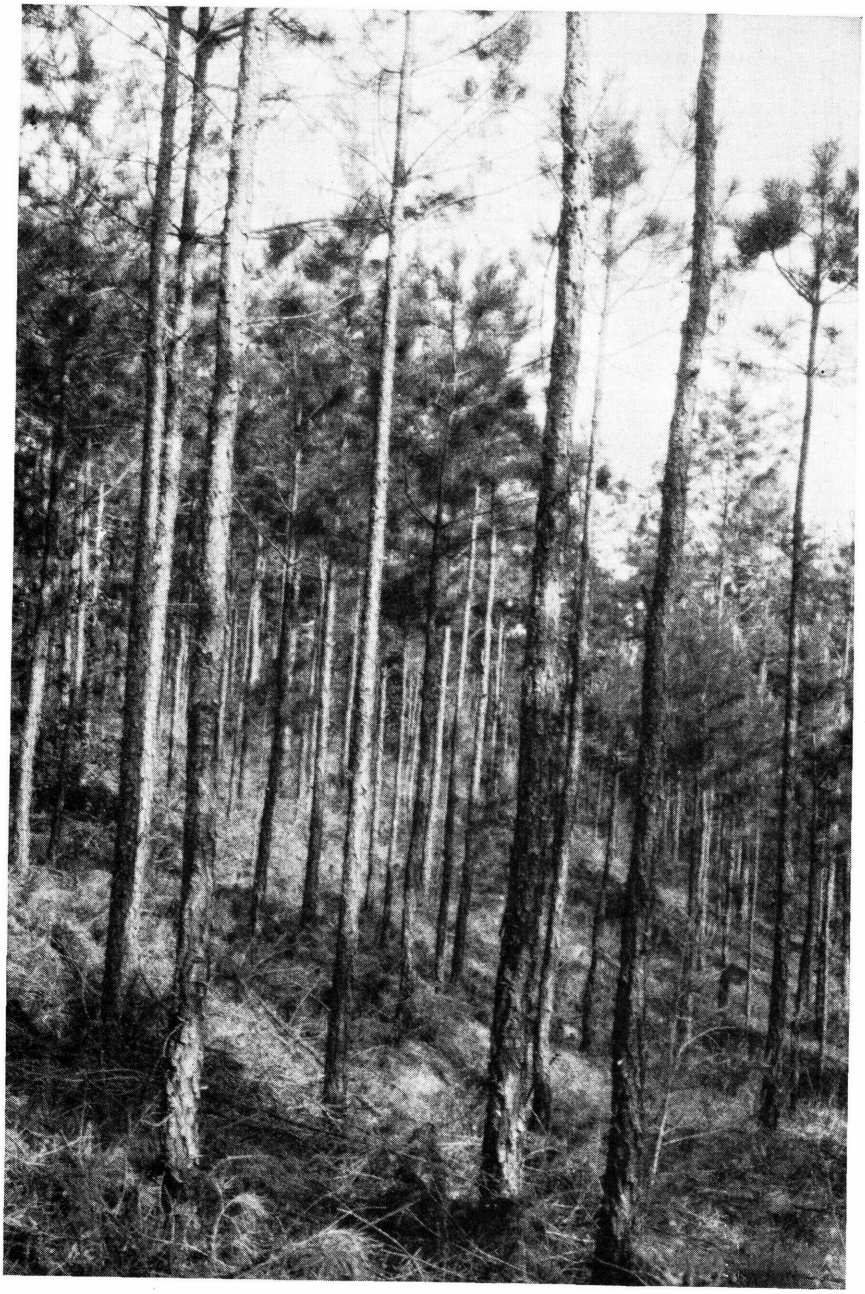

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FIGURE 22.—An example showing pruning carried to excess. Only selected trees should have been pruned. Some of the trees were pruned too high, or more than two-thirds of their height. Pruning trees when the limbs are small is relatively inexpensive and gives them an early start in putting on annual layers, or rings, of clear wood.

an average spacing of 10 by 10 feet each way. The poorer trees were cut as a thinning in connection with the operation.

The pruning part of the operation required about 93 man-days of 8 hours each, or an average product of 40 trees per man per day, or 5 trees per man per hour. The thinning and brush piling on the tract required about 75 man-days. The cost of pruning, at a labor rate of $2.40 per day of 8 hours, amounted to about 6 cents per tree, with an additional estimated cost of about 2 cents for handling the brush, or a total of 8 cents per tree. The pruning was done with the expectation of increased returns from the clear-lumber product, which, in the case of white pine, probably brings on an average from two to three times as much as is received from the sale of very knotty grades.[9] [10]

*An example in Mississippi.*—In one accurately recorded test case, 1,200 open-grown limby southern pines, ranging mostly from 3 to 8 inches in diameter, were pruned up to 17 feet in height.[11] Several different kinds of tools and methods of pruning were used.

The results for the average of all kinds of tools and methods were recorded, as were also the average results from using the most efficient kinds of tools and methods recommended elsewhere in this bulletin. The latter set of results is of interest. They are based on the use of the best types of hand pruning saws or shears up to a height of 7 feet, a short pole saw from 7 to 12 feet, and a longer pole saw from 12 to 17 feet—this requires a three-man saw crew. The trees, 4 inches in diameter, required a total of about 2 minutes each of actual work time, the 6-inch trees about 3 minutes, and the 8-inch trees about 4½ minutes. The full working time (including walking from tree to tree, resting time, etc.) amounts to an estimated 50 percent more, or 3, 4½, and 6¾ minutes for the three sizes of trees, respectively. An addition of about 25 percent of time should be made for a fourth man to pull the brush, or limbs, away from the trees and scatter or pile them.

The total labor cost of pruning the stand, based on the foregoing data, with labor figured at $2.40 for an 8-hour day, amounted to approximately 2 cents each for the 4-inch trees, 3 cents for the 6-inch trees, and 4 cents for the 8-inch trees. The records showed only a slight difference in cost when the pruning was done by two men, one working up to 8 feet in height, and the other with a pole saw from 8 to 17 feet, inclusive.

The operation described was conducted on a stand of open-grown and limby longleaf pine. This class, or quality, of trees comprises a considerable portion of the old-field or open-grown stands over the South whether of shortleaf, loblolly, longleaf, or slash pines.

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[9] SIMMONS, E. M. PRUNING AND THINNING A WHITE PINE PLANTATION IN THE SOUTHERN APPALACHIANS. Jour. Forestry, 33 : 519–522. 1935.

[10] A stand of eastern white pine in New England, pruned to 17 feet in height, after 30 years showed a yield (1940) of 30 percent of the highest grades (C Select and Better) as compared with only 1.3 percent from similar unpruned trees. Sixty-nine percent of the lumber graded No. 1 Common and Better as contrasted with only 14 percent from the unpruned trees. The value of all lumber cut from the unpruned trees averaged $29.90 per thousand feet as compared with a value of $45.10 for that sawed from the pruned trees. (From Cost of Producing White Pine Lumber in New England, Circular 557, U. S. Dept. of Agriculture. 1940.)

[11] Pruning test conducted on longleaf pines on the McNeill division, Harrison Experimental Forest, in southern Mississippi, by the Southern Forest Experiment Station of the U. S. Forest Service.

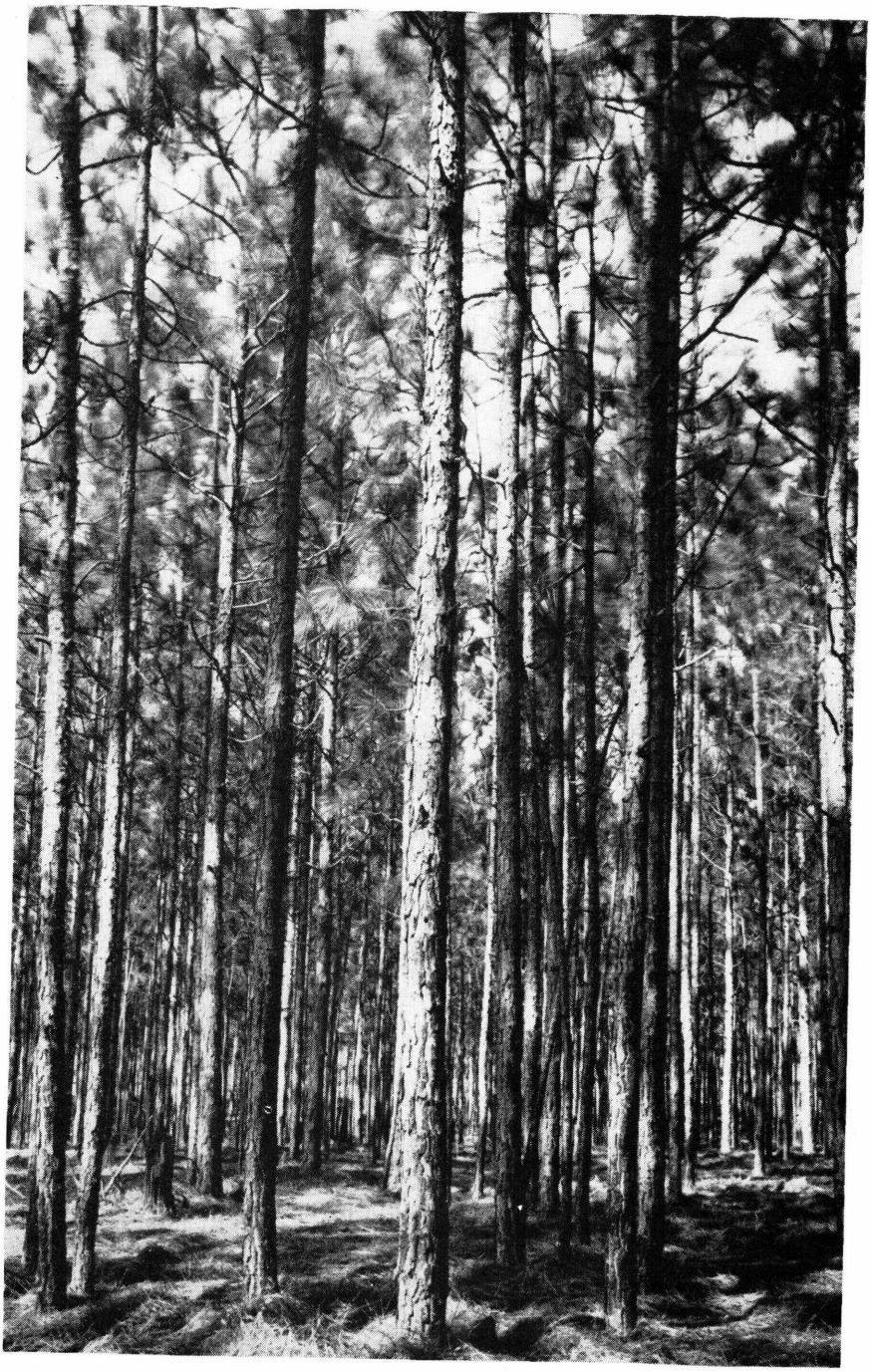

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FIGURE 23.—Here nature has done a fair job of pruning because the stand is fully stocked—in fact, it is overcrowded and should have been thinned several years ago. This is longleaf pine on a good site, or location.

## FUTURE OF PRUNING IN THE SOUTH

Pruning pines as a common practice is apparently in its infancy in the South. As a result, only general suggestions as to tools and methods have been attempted in this bulletin, since neither has thus far been well worked out experimentally or by practical experience.

Open-grown, limby trees occur generally over the South whether the stands are of shortleaf, loblolly, slash, or longleaf pines, or a mixture of these species (see back cover). However, under the most favorable conditions of fully stocked stands and good site, or location, southern pines undergo a natural pruning (fig. 23).

As a starting point for farmers and other landowners who are interested in timber farming and the improvement of their pines, it will undoubtedly appear as a safe venture to put their own or hired labor to work during off seasons pruning selected trees or stands. From such a beginning farmers and other timberland owners should gradually come to the point where they can determine fairly well the degree to which labor costs and prospective markets will make forest pruning economically profitable.

Some day complete pruning rules will probably be perfected for each of the different species and prevailing forest conditions. Such rules would specify rather definitely the number of trees per acre to be selected and pruned in stands of specified average-sized trees growing on different grades of soil, or site conditions, and also indicate fairly closely the average cost and the expected increase in the quality and value of the resulting forest products.

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*For further information consult your county agricultural agent or write to your extension forester at the State college of agriculture, your State forester at the State capitol, or the*

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BACK COVER.—CONTRAST BETWEEN A PRUNED AND AN UNPRUNED PINE TREE. F-383030.